UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF VIRGINIA
Norfolk Division

THE FOX GROUP, INC.,

Plaintiff,

v.

ACTION NO. 2:10cv314

CREE, INC.,

Defendant.

OPINION

This matter comes before the court for claim construction. On April 18, 2011, the court conducted a hearing pursuant to Markman v. Westview Instruments, Inc., 517 U.S. 370, 372 (1996) ("Markman hearing"), and heard argument from both parties as to the meaning of the terms in the disputed claims of the patents at issue. This Opinion details the court's claim construction and explains its reasoning. See MercExchange LLC v. eBay, Inc., 401 F.3d 1323, 1329 (Fed. Cir. 2005), vacated on other grounds, eBay, Inc. v. MercExchange LLC, 547 U.S. 388 (2006).

I. Procedural History

This case involves the alleged infringement of U.S. Patent Number 6,562,130 ("the '130 patent") and U.S. Patent Number 6,534,026 ("the '026 patent"), which are owned by The Fox Group, Inc. ("Fox") and relate to growth of silicon carbide (SiC), a semiconductor material composed of silicon and carbon. Fox

filed suit on June 29, 2010, seeking injunctive relief against alleged patent infringement by Cree, Inc. ("Cree"), as well as compensatory damages.[1] Fox alleges that "Cree has been making, using, selling, and/or offering for sale silicon carbide substrates and products that use silicon carbide that practice the invention of the '026 patent [and the '130 patent], and thus, infringe one or more claims of [those patents.]" Compl. ¶¶ 21 and 34, ECF No. 1. Fox also alleges that Cree will continue to infringe those patents unless enjoined by the court. Id. ¶¶ 22 and 35. On August 30, 2010, Cree answered the Complaint and filed a counterclaim against Fox seeking declarations that the claims of the '026 and '130 patents are (1) not infringed; (2) invalid; and (3) unenforceable. See Answer 32-33, ECF No. 12. Cree also seeks an award of attorney's fees and costs. Fox answered Cree's counterclaim on September 23, 2010.

Pursuant to this court's 16(b) scheduling order and a subsequent order extending filing times, the parties submitted their initial claim construction briefs on January 28, 2011, their reply claim construction briefs on February 10, 2011, and

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[1] Fox brought suit against two defendants: Cree and Dow Corning, Corp. On October 25, 2010, the action against Dow Corning was transferred to the district court for the Southern District of New York. See Fox Group, Inc. v. Cree, Inc., 749 F. Supp. 2d 410, 414 (E.D. Va. 2010).

their joint claim construction brief on February 24, 2011. On March 8, 2011, this court scheduled a Markman hearing to aid the court in construing the disputed terms of the two patents. The court held the Markman hearing on April 18, 2011, and heard argument on the issue of claim construction. At the end of the hearing, the court took the matter under advisement and permitted the parties to submit post-hearing submissions on or before April 29, 2011. On April 29, 2011, Fox and Cree each filed a supplemental claim construction brief.

II. Factual Background

SiC crystal is a semiconductor material grown via man-made methods and used in high-temperature and high-power electronics such as light sources, power diodes, and photodiodes. The quality of the SiC material (i.e. a low level of defects) is critical to its viability as a semiconductor. For many years, the growth methods available made it difficult to produce low-defect SiC in a form that makes SiC commercially viable as a semiconductor. The general growth method at issue here is seeded sublimation, in which single crystal SiC is grown in crucibles under high heat. Specifically, a "seed" crystal of SiC is inserted into a crucible along with SiC "source" material -- typically SiC powder. Heat is applied to the crucible, causing the SiC source material to sublime -- turn from solid to

gas -- and then condense on the seed, thereby growing a single crystal SiC material that can be processed into semiconductors for electronic devices.

The inventions set forth in the two patents at issue purportedly enable growth of commercially viable, low-defect single crystal SiC. SiC grown by utilizing the specific seeded sublimation method and apparatus set forth in each patent should contain low levels of those defects typically associated with SiC crystal growth: dislocations, micropipes, and secondary phase inclusions. The '130 patent describes low-defect SiC growth away from the seed crystal in an "axial" direction. The '026 patent also describes low-defect SiC growth away from the seed crystal, but it describes the growth in both an axial and a "lateral" direction.[2]

The '130 patent is entitled "Low Defect Axially Grown Single Crystal Silicon Carbide." It contains twenty-six (26) claims, all of which assert certain properties of SiC material grown by utilizing the method and apparatus provided for in the '130 patent. Independent claims 1, 7, 13, and 19 are at issue

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[2] According to Fox, the '026 patent is "an improvement on the invention of the '130 patent," as "[t]he inventors discovered that their '130 invention could be used to make higher quality crystal in areas of lateral growth than in the central region." Fox Opening Claim Construction Br. 9, ECF No. 53 [hereinafter "Fox's Opening Br."].

in this proceeding. With one exception, claims 1, 7, and 13 are identical. All three claims assert:

> A silicon carbide material comprising an axial region of re-crystallized single crystal silicon carbide with a density of dislocations of less than [a specified amount], a density of micropipes of less than 10 per square centimeter, and a density of secondary phase inclusions of less than 10 per cubic centimeter.

See '130 patent col.8 ll.6-11 and 39-44, Ex. I to Compl., ECF No. 1-9 [hereinafter "'130 patent"]; id. col.9 ll.4-9. The exception is that each claim specifies a different "density of dislocations": claim 1 requires a density of dislocations of less than 10^4 per square centimeter, claim 7 requires less than 10^3 per square centimeter, and claim 13 requires less than 10^2 per square centimeter.

Claim 19 is similar to claim 1. It requires "silicon carbide material" having the same density of dislocations, the same density of micropipes, and the same density of secondary phase inclusions as required in claim 1. Unlike claim 1, however, claim 19 requires a "silicon carbide seed crystal," id. col.9 l.38, and "a region of axially re-crystallized silicon carbide . . . initiating at [the] growth surface of . . . [the] seed crystal.'" Id. cols.9 l.41 - 10 l.1. The differences in claim 19 as compared to claim 1 are underscored below for ease of comparison:

19. A silicon carbide material, comprising:

A single crystal silicon carbide seed crystal, said single crystal silicon carbide seed crystal having a growth surface; and

A region of axially re-crystallized silicon carbide, said region of axially re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal, said region of axially re-crystallized silicon carbide having a density of dislocation of less than 10^4 per square centimeter, a density of micropipes of less than 10 per square centimeter, and a density of secondary phase inclusions of less than 10 per cubic centimeter.

Id. cols.9 l.37 - 10 l.6 (emphasis added).

The '026 patent is entitled "Low Defect Density Silicon Carbide." It consists of fourteen (14) claims, all of which assert certain properties of a SiC material grown by utilizing the method and apparatus provided for in the '026 patent. Independent claims 1 and 7 are at issue in this suit. They are similar. Their differences are underscored below in claim 7 for ease of comparison:

1. A silicon carbide material comprising:

a single crystal silicon carbide seed crystal, said single crystal silicon carbide seed crystal having a first density of defects, said defects comprised of micropipes and dislocations;

an axial region of re-crystallized silicon carbide, said axial region grown off of said single crystal silicon carbide seed crystal, said axial region having a second density of defects, said defects comprised of micropipes and dislocations; and

a lateral region of re-crystallized silicon carbide, said lateral region grown off of said single crystal silicon carbide seed crystal, said lateral region having a third density of defects, said defects comprised of micropipes and dislocations, wherein said third defect density is less than said first defect density and less than said second defect density, and wherein said third defect density is less than 10^4 per square centimeter.

7. A silicon carbide material comprising:

a single crystal silicon carbide seed crystal, said single crystal silicon carbide seed crystal having a first density of defects, said defects comprised of micropipes and dislocations, said single crystal silicon carbide seed crystal having a growth surface;

a first region of re-crystallized silicon carbide, said first region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal, wherein a first portion of a crystallization growth front corresponding to said first region of re-crystallized silicon carbide follows an axial growth path, said first region of re-crystallized silicon carbide having a second density of defects, said defects comprised of micropipes and dislocations; and

a second region of re-crystallized silicon carbide, said second region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal, wherein a second portion of said crystallization growth front corresponding to said second region of re-crystallized silicon carbide follows a laterally expanding growth path, wherein an outermost edge of said second portion of said crystallization growth front is at an angle of greater than 25 degrees as measured from a normal growth axis, said second region of re-crystallized silicon carbide having a third density of defects, said defects comprised of micropipes and dislocations, wherein said third density of defects is less than said first density of defects and less than said second density of defects, and wherein said third density of defects is less than 10^4 per square centimeter.

'026 patent, cols.10 l.18 - 11 l1.21, Ex. F to Compl., ECF No. 1-6 [hereinafter "'026 patent"] (emphasis added); see Cree's Opening Claim Construction Br. 9, ECF No. 54 [hereinafter "Cree's Opening Br."] (explaining that claim 7, instead of referring to "axial" and "lateral" regions like claim 1, refers to "first" and "second" regions).

III. Claim Construction

Claim construction is a matter of law to be decided by the court. Markman, 517 U.S. at 372. The goal of such construction is to "discern the meaning of [a] term in the context of [the] invention and field of art." Curtiss-Wright Flow Control Corp. v. Velan, Inc., 438 F.3d 1374, 1379 (Fed. Cir. 2006). In performing this function, the court need only construe disputed terms of disputed claims of the patent to the extent necessary to resolve the controversy. See NTP, Inc. v. Research In Motion, Ltd., 418 F.3d 1282, 1311 (Fed. Cir. 2005) (citing Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc., 200 F.3d 795, 803 (Fed. Cir. 1999)).

Sitting en banc, the Federal Circuit gave an overview of claim construction in Phillips v. AWH Corp., 415 F.3d 1303 (Fed. Cir. 2005). Overall, claim construction aims to determine the "meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of

the effective filing date of the patent application." Id. at 1313 (emphasis added). In some instances, a term's ordinary meaning "may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words." Id. at 1314. However, when the term's meaning is not readily apparent, courts must consult "those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean." Id. (citations and internal quotation marks omitted). Those sources include both intrinsic evidence, such as the claims, specification and prosecution history, and extrinsic evidence, such as technical dictionaries, treatises and expert testimony. See Chamberlain Group, Inc. v. Lear Corp., 516 F.3d 1331, 1335 (Fed. Cir. 2008). Intrinsic evidence is considered to be "more reliable" than extrinsic evidence, id., and thus it should be the court's "primary focus in determining the ordinary and customary meaning." Atofina v. Great Lakes Chem. Corp., 441 F.3d 991, 996 (Fed. Cir. 2006).

The claim construction process begins with the words of the claims themselves, Old Town Canoe Co. v. Confluence Holdings Corp., 448 F.3d 1309, 1315 (Fed. Cir. 2006), focusing on the context in which the term is used. Phillips, 415 F.3d at 1314.

"It is a bedrock principle of patent law that the claims of a patent define the invention to which the patentee is entitled the right to exclude." Id. at 1312 (citations and internal quotation marks omitted). Each disputed term is to be given its ordinary and customary meaning. See id. In seeking the plain meaning, the court is concerned with fair notice to the public concerning the scope of the claims. Johnson & Johnston Assocs., Inc. v. R.E. Serv. Co., 285 F.3d 1046, 1052 (Fed. Cir. 2002). Because claim terms are normally used consistently throughout the patent, other claims, both asserted and unasserted, may be instructive as to the meaning of the disputed term. Phillips, 415 F.3d at 1314. Differences among claims may also be helpful, as limitations in dependent claims can clarify the independent claims from which they derive. Id. at 1314-15.

The claims, however, "do not stand alone" and must be "read in view of the specification, of which they are a part." Id. at 1315 (citations and internal quotation marks omitted). The entirety of the specification is relevant to claim construction, including the abstract, summary and preferred embodiment. See generally Lucent Techs., Inc. v. Gateway, Inc., 525 F.3d 1200 (Fed. Cir. 2008) (examining the entirety of the specification in performing claim construction). The specification "is always highly relevant to the claim construction analysis. Usually, it

is dispositive; it is the single best guide to the meaning of a disputed term." Phillips, 415 F.3d at 1315 (citations and internal quotation marks omitted). Further, if the specification reveals "a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess," then "the inventor's lexicography governs." Id. at 1316; see Edwards Lifesciences LLC v. Cook Inc., 582 F.3d 1322, 1329 (Fed. Cir. 2009). The patentee must, however, "clearly express that intent in the written description." Helmsderfer v. Bobrick Washroom Equip., Inc., 527 F.3d 1379, 1381 (Fed. Cir. 2008). The specification may also limit the scope of the invention through an intentional disclaimer or disavowal. Phillips, 415 F.3d at 1316. Nevertheless, it is important that the court "avoid the danger of reading limitations from the specification into the claim," as "persons of ordinary skill in the art rarely would confine their definitions of terms to the exact representations depicted in the embodiments." Id. at 1323.

In addition to the claims and specification, the court may also consider the prosecution history, which "consists of the complete record of the proceedings before the [Patent and Trademark Office] and includes the prior art cited during the examination of the patent." Id. at 1317. Although the

prosecution history provides evidence of how the Patent and Trademark Office ("PTO") and the inventor understood the patent, the court must keep in mind that because it "represents an ongoing negotiation between the PTO and the applicant, rather than the final product of that negotiation, it often lacks the clarity of the specification and thus is less useful for claim construction purposes." Id.

As far as extrinsic evidence, the court is not "barred from considering any particular sources or required to analyze sources in any specific sequence, as long as those sources are not used to contradict claim meaning that is unambiguous in light of the intrinsic evidence." Id. at 1324. The district court, in its discretion, may admit extrinsic evidence to help educate itself about the field of the invention in order to determine how a person of ordinary skill in the art would understand the claim terms. Id. at 1319.

IV. Claim Terms

The parties do not always agree on which terms in a claim require construction. In several instances, Fox proposes a phrase be construed as one term, whereas Cree parses that phrase into separate terms and seeks their separate construction. In such cases, the court begins with Fox's proposed term, and, to the extent necessary to resolve the controversy, separately

construes the component terms as proposed by Cree. In other instances, Cree seeks construction of a phrase, whereas Fox proposes construction of only part of that phrase. In those cases, the court construes claim terms to the extent necessary to resolve the parties' dispute, "to clarify and when necessary to explain what the patentee covered by the claims, for use in the determination of infringement." U.S. Surgical Corp. v. Ethicon, Inc., 103 F.3d 1554, 1568 (Fed. Cir. 1997).

A. '130 Patent

The court construes the following four terms found in claims 1, 7, 13 and 19: (1) "axial region of re-crystallized single crystal silicon carbide" / "region of axially re-crystallized silicon carbide,"[3] (2) "density of dislocations," (3) "density of micropipes," and (4) "density of secondary phase inclusions."

1. "axial region of re-crystallized single crystal silicon carbide" / "region of axially re-crystallized silicon carbide"

Fox proposes that the phrases "axial region of re-crystallized single crystal silicon carbide," which appears in

[3] The first term appears in claims 1, 7 and 13. The second term appears in claim 19. As the parties appear to agree, the phrasing difference between "axial" and "axially" is immaterial to construction.

claims 1, 7, and 13, and "region of axially re-crystallized silicon carbide," which appears in claim 19, be construed as one term that is applicable across the claims. See Am. Piledriving Equip., Inc. v. Geoquip, Inc., 627 F. 3d 1324, 1333 (Fed. Cir. Mar. 21, 2011) ("Where a claim term is used consistently throughout the claims, 'the usage of [the] term in one claim can often illuminate the meaning of the same term in other claims.'"). Fox's proposed construction is "a portion of a bulk crystal grown in a direction toward the source substantially perpendicular to the seed crystal plane by physical vapor transport."[4]

Cree proposes different terms be construed. Specifically, Cree proposes that "axial" and "axially" be construed as one term that is applicable across the claims, see id., and that "re-crystallized" be separately construed. Cree's proposed construction for "axial [region]"[5] is "the single and entire region extending in a direction perpendicular (i.e., normal) to

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[4] Fox's proposed construction is a revision from that provided in its claim construction brief. See Fox's Supplemental Claim Construction Mem. 3, ECF No. 204.

[5] In Cree's submissions to the court, it places brackets around words that provide context for the claim terms it wishes construed. Although this method is useful in theory, Cree employs it inconsistently, often proposing constructions that construe the bracketed words as well.

and from the seed crystal."[6] Cree's proposed constructions for "[region of] re-crystallized [silicon carbide or single crystal silicon carbide]" is "region of silicon carbide crystal made into a crystal again."

There is no apparent utility in parsing Fox's proposed term in order to construe the claims and resolve the dispute. Even if the court separately construes "axial," "axially," and "re-crystallized," those terms must be reconciled to provide a coherent meaning for the claim as a whole. Indeed, Cree concedes this by highlighting the context of its proposed terms in brackets.[7] Furthermore, the claim language provides substantial guidance that the phrases "axial region of re-crystallized single crystal silicon carbide" and "region of axially re-crystallized silicon carbide," are unitary terms in the patent, as they are used consistently in their respective dependent claims,[8] and neither "axial," "axially," nor "re-

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[6] Cree's proposed construction is a revision from that provided in its claim construction brief. See Cree's Supplemental Claim Construction Mem. 3, ECF No. 205.

[7] See supra note 5.

[8] For example, dependent claims 2 through 5 claim "[t]he silicon carbide material of claim 1, wherein said axial region of re-crystallized single crystal silicon carbide has a [certain] impurity concentration of [a specified amount]." See '130 patent col.8 ll.12-35 (emphasis added). Dependent claims 8 through 11, 14 through 17, and 20 through 25 make analogous claims for independent claims 7, 13, and 19, respectively.

crystallized" recur in any other context. The court declines to unnecessarily multiply the number of terms requiring construction, and, thus, construes Fox's proposed term.[9]

Having determined the term requiring construction, the court begins its analysis.[10] There is no substantive dispute as to the meaning of the word "axial." See, e.g., Cree's Reply Claim Construction Brief 20, ECF No. 62. Accordingly, the court adopts Fox's proposed construction and finds that it means "a direction substantially perpendicular to the seed crystal plane." The parties dispute the rest of the term. The term's ordinary meaning as understood by a person of skill in the art is not readily apparent, and so the court must examine "sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean." Phillips, 415 F.3d at 1314 (citations and internal quotation marks omitted). The first source is the claims themselves. The

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[9] Importantly, this resolution does not nullify Cree's claim construction arguments.

[10] As there is no dispute that the phrasing difference between "axial" and "axially" is immaterial to construction, see supra note 3, the construction of the term "region of axially re-crystallized silicon carbide" found in claim 19 will equate to the court's construction of the term "axial region of re-crystallized single crystal silicon carbide" found in claims 1, 7, and 13. See Am. Piledriving, 637 F.3d at 1333. Accordingly, the court only refers to the term "axial region of re-crystallized single crystal silicon carbide" in its claim construction analysis.

claims do not define the term "axial region of re-crystallized single crystal silicon carbide." Turning to the other intrinsic evidence, both parties argue that their construction is derived from the context of the invention as set forth in the specification. Fox argues that the background of the invention "describes various prior art methods, and the inefficiencies associated with each of these methods," and, thus, "frames the context of the invention as producing a single SiC crystal boule using bulk growth techniques, as opposed to the previously known Lely method or close-spaced sandwich sublimation method." Fox Opening Claim Construction Br. 13-14, ECF No. 53 [hereinafter "Fox's Opening Br."]. Fox asserts that the specification describes the apparatus for bulk growth of a single SiC crystal, which "establishes that the context of the invention is 'a portion of a boule grown . . . in a direction toward the source substantially perpendicular to the seed crystal plane by heating source silicon carbide to form a gaseous phase that condenses onto the seed as substantially a single crystal.'" Id. at 14-15 (citations omitted).

Whereas Fox considers it critical to construe the term to clarify the process of growing low-defect SiC, Cree argues that "[t]he issue in dispute is whether the entirety of the recited regions or seed must meet the density limitations (Cree) or only

portions of the regions or seeds (Fox)." Cree's Opening Br. 20. In other words, Cree considers it critical to construe the term so as to explicate that there is only one axial region, it is the SiC crystal grown via the method and apparatus described in the '130 patent, and it must meet the claimed defect densities (e.g., "a density of dislocations of less than 10^4 per square centimeter, a density of micropipes of less than 10 per square centimeter"). Cree derives its construction from the specification's discussion of the "axial growth zone" and the fact that the patent makes no mention of subdividing the axial region when testing for defects.

Although the claims do not define the term, they provide guidance in formulating its proper construction, and reveal that Cree is incorrect that the patent contemplate only one axial region. All of the disputed claims describe "a silicon carbide material comprising an axial region of re-crystallized single crystal silicon carbide." E.g., '130 patent col.8 ll.6-7 (emphasis added). When used as a transition phrase, as is the case here, the "usual and generally consistent meaning of . . . 'comprising' [is] that the ensuing elements or steps are not limiting." CIAS, Inc. v. Alliance Gaming Corp., 504 F.3d 1356, 1360 (Fed. Cir. 2007) ("In the patent claim context the term 'comprising' is well understood to mean 'including but not

limited to.'"). Moreover, the Federal Circuit "has repeatedly emphasized that an indefinite article 'a' or 'an' in patent parlance carries the meaning 'one or more' in open-ended claims containing the transitional phrase 'comprising.'" Baldwin Graphic Sys., Inc. v. Seibert, Inc., 512 F.3d 1338, 1342 (Fed. Cir. 2008) (citations omitted). Accordingly, unless an exception to this rule is met, the claims explicitly contemplate one or more axial regions.

"The exceptions to this rule are extremely limited: a patentee must 'evince[] a clear intent' to limit 'a' or 'an' to 'one.'" Id. (citations omitted). Here, neither "the language of the claims themselves, the specification, [n]or the prosecution history necessitate a departure from the rule." Id. at 1343 (citations omitted). Contrary to Cree's characterization, nothing in the specification indicates that there is only one axial region in each SiC crystal. Cree argues that Figure 1 -- "a cross-sectional view of [the apparatus in which the SiC material is grown] according to the invention," '130 patent col.3 ll.66-67 -- labels the axial region as a single zone.

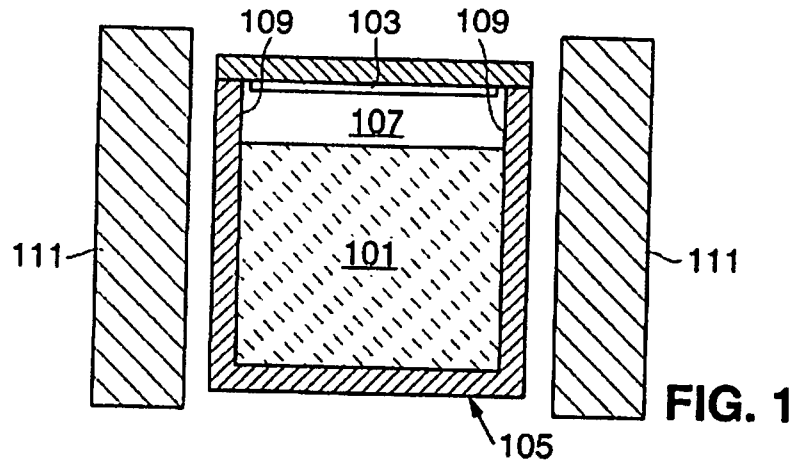

FIG. 1

This is wrong. Figure 1 and the specification describe the "axial growth zone," not the "axial region," as a single zone. As set forth in the specification, "[a]n axial growth zone **107** is defined by the substantially parallel surfaces of source **101** and seed **103** in combination with sidewalls **109** of crucible **105**." Id. col.4 ll.13-15. In other words, the "axial growth zone" is the space in the crucible where the SiC material is grown, see id. col.5 ll.47-56 (providing that "a stable composition of the vapor phase within growth zone **107** can be achieved" (emphasis added)), but it is not a region within the SiC material. Discussion of the axial growth zone sheds no light on the proper construction of the term "an axial region" and, therefore, does not necessitate departure from the rule.

Similarly, it is immaterial that the intrinsic evidence does not indicate that "an axial region" is subdivided for the

purposes of measuring the defect densities claimed in the patent. The SiC material can be subdivided into one or more axial regions for the purpose of measuring the defect densities. In other words, the claims contemplate that one axial region in the SiC material may satisfy the claimed defect densities and other axial regions within that same SiC material may not. Indeed, Fox does not dispute that the claims establish that the same axial region must meet all of the claimed defect densities. For the above reasons, the court finds that a person of ordinary skill in the art at the time of the invention would have understood that the patent claims one or more axial regions in the SiC material that meet the claimed defect densities, while allowing for other axial regions in that same SiC material that do not meet those same claimed defect densities.

The ordinary and customary meaning of the phrase "re-crystallized single crystal silicon carbide" is not discoverable through the claims themselves, but the specification resolves the matter. The court agrees with Fox that the specification, read as a whole, clearly describes a method of growing SiC, where source material is heated until it becomes a vapor, which subsequently condenses on the seed to form a SiC crystal. The background of the invention only describes methods for growing SiC that "utilize[e] vapor-phase crystallization of evaporated

solid silicon carbide," id. col.1 ll.29-30, in which the "growth surface [is on] the SiC seed crystal." Id. col.2 l.17. Furthermore, the description of the invention itself "leads to the inescapable conclusion," Alloc, Inc. v. Int'l Trade Comm'n, 342 F.3d 1361, 1370 (Fed. Cir. 2003), that the claimed invention is predicated on a growth method in which source SiC sublimes and then condenses on the seed crystal. See, e.g., '130 patent col.3 ll.28-32 (describing the invention as requiring a "evaporating surface" for the source SiC material, "a SiC seed crystal," and a growth surface); id. ll.38-46 (providing that the crucible in which the SiC material is grown is "no longer capable of absorbing SiC vapors as the monocrystalline silicon carbide is grown" (emphasis added)); id. col.5 ll.11-14 (describing the process of "evaporation of the SiC of source 101 and vapor phase crystallization of SiC on the growing surface of seed 103").

The court cannot agree, however, that the specification establishes a method directed toward "bulk" growth. Rather, the clear and consistent description of the invention is a method directed toward growth of low defect SiC. See id. col.3 ll.10-14 ("[W]hat is needed in the art is a method and system that allows high quality SiC single crystals to be grown. The present invention provides such a method and system.").

Although the embodiments certainly indicate that a large crystal can be grown, see id. col.5 ll.22-26 and 46-50, this is an insufficient basis from which to read a limitation of "bulk" growth into the claims. See Alloc, 342 F.3d at 1370 ("[T]his court looks to whether the specification refers to a limitation only as a part of less than all possible embodiments or whether the specification read as a whole suggests that the very character of the invention requires the limitation be a part of every embodiment."). Nothing in the specification explicitly contrasts the size of a SiC crystal grown through the method and apparatus described in the '130 patent to SiC crystals grown through other methods. The specification merely provides that examples of "as-grown single crystals were approximately 10 millimeters thick with diameters ranging between 20 and 75 millimeters." '130 patent col.7 ll.47-49. Fox asserts that "[t]hese dimensions are consistent with boule growth and cannot be achieved by close-spaced sandwich sublimation methods," Fox's Opening Br. 15, but its only support is expert testimony.[11]

[11] Fox also highlights an invention that grows "relatively small crystals, typically less than 1 millimeter thick." '130 patent col.2 ll.22-26. This shows that the '130 patent's invention can grow crystals larger than that other invention, but it does not provide sufficient support to read a size limitation into the claim, as there is no mention of crystal size in the discussion of the other inventions in the background of the invention. Furthermore, the specification does not call attention to the size of the as-grown SiC crystal as an

Although such extrinsic evidence may "shed useful light on the relevant art," Phillips, 415 F.3d at 1317 (citations and internal quotation marks omitted), the court will not import a limitation from it without any indicia of such a limitation in the patent itself. Nothing in the specification provides a clear basis to find that "the claimed invention is narrower than the claim language might imply," as regards the scale of SiC growth. Alloc, 342 F.3d at 1370. Accordingly, the court will not limit the claim term with any description of the size of the as-grown SiC crystal.

For the above reasons, the court construes "axial region of re-crystallized single crystal silicon carbide" to mean "portion of a silicon carbide crystal that is grown in a direction substantially perpendicular to the seed crystal plane by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal."[12]

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innovation. Rather, it consistently highlights the quality of the SiC crystal as the invention's central feature. On the record before the court, there is no basis to read a limitation into the claims that excludes the '130 patent's invention from others by virtue of the size of the as-grown SiC crystal. See Phillips, 415 F.3d at 1323.

[12] The parties agreed that the term "seed crystal" in claim 19 means "crystal on which another crystal is grown." At this stage of the proceeding, the court does not incorporate this agreed construction into its construction of the disputed term.

2. "density of dislocations"

Fox proposes that "density of dislocations," which appears in claims 1, 7, 13, and 19, be construed as one term, and Cree proposes that "density of" and "dislocations" be separately construed.[13] Fox's proposed construction is "concentration of defects where lines of atoms in a crystal structure are displaced, including screw, edge, and basal plan dislocations, that intersect the surface being measured."[14] Cree proposes that "a density of [dislocations]"[15] be construed as "the total length of dislocations per unit volume." Cree has "no objection to this Court adopting Fox's revised construction of 'dislocations.'" See Cree's Supplemental Claim Construction Mem. 9, ECF No. 205. Since there is no dispute that "dislocations" should be construed as "defects where lines of atoms in a crystal structure are displaced, including screw, edge, and basal plane dislocations," in order to resolve the parties' dispute, the court need only determine the proper

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[13] Cree also proposes that "a density of" be construed separate from the other two defects in the disputed claims: micropipes and secondary phase inclusions. See infra Parts IV.A.3. and 4.

[14] Fox's proposed construction is a revision from that provided in its claim construction brief. See Fox's Supplemental Claim Construction Mem. 2.

[15] See supra note 5.

construction of "density of" as that phrase relates to dislocations.

The court first sets forth the contours of the parties' fundamental disagreement, as it informs how each party approaches the construction of the term "density of dislocations," as well as the other density limitations found in the claims.[16] The parties dispute the proper technique for measuring defects in an axial region of re-crystallized crystal silicon carbide. Fox argues that only those defects intersecting the surface of an axial region should be counted toward the defect thresholds specified in the claims. In other words, even if a one cubic centimeter axial region contains 10^5 dislocations below its surface, it can still satisfy claim 1's 10^4 per square centimeter limitation. Cree, on the other hand, argues that all defects in an axial region must be counted to determine whether said region meets the defect limitations set forth in the claims. So in the case of a dislocation defect, Cree claims that "[t]he appropriate, and most accurate method of measurement is [] to take the length of the dislocations present, and divide that length over the volume of the region being measured." Id. at 14. In other words, if a one cubic centimeter axial region contains 10^5 centimeters of dislocations

[16] See supra note 13.

below the surface, it cannot satisfy claim 1's 10^4 per square centimeter limitation, even if those dislocations are not detectable on the surface.

The claims explicitly set forth the unit of measurement for each type of defect. Cree seeks a construction of "a density of" that parallels the applicable unit. In the case of dislocations, the claims set forth a unit of "square centimeter[s]," and so Cree seeks a construction that means "the total length of dislocations per unit volume."[17] Cree's construction is mathematically sound,[18] but there is no basis in the claims or specification to reformulate the applicable unit of measurement as length per unit volume, rather than by the number of occurrences.[19] The claims and specification merely refer to the dislocation density as a measure per square centimeter without any further guidance. See, e.g., '130 patent col.2 ll.29-33; id. col.8 ll.39-40. The only permissible inference is that the term "density of" communicates that the

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[17] If dislocations are measured by length in centimeters and an axial region is measured by volume in cubic centimeters, then the applicable unit of measurement for dislocations in a region is square centimeters -- $cm/cm^3 = cm^2$.

[18] See supra note 17.

[19] To illustrate, if an axial region contains ten dislocations, each five centimeters in length, then it is just as accurate to quantify the dislocations as ten in number as it is to quantify them as fifty centimeters in length.

patent is concerned with the extent to which defects are present in an axial region.

Cree's only support for its construction is scientific articles. Extrinsic evidence is generally viewed as less reliable than intrinsic evidence. See Phillips, 415 F.3d at 1318. The court is most concerned that Cree "naturally [chose] the pieces of extrinsic evidence most favorable to its cause, leaving the court with the considerable task of filtering the useful . . . from the fluff." Id. This filtering process reveals that Cree did just that, as the extrinsic evidence actually supports both its position and Fox's position. See, e.g., Ex. 14 to Borchers Decl. in Supp. of Cree's Opening Br., ECF No. 58-11 (remarking that "[m]any experimental methods are available for estimating dislocation densities, [including] direct counts . . . of dislocation nucleated etch pits on the surface"); Ex. 15 to Borchers Decl. in Supp. of Cree's Opening Br., ECF No. 58-12 ("The density of dislocations is then the number of dislocation lines intersected by a plane of unit area normal to them."). Accordingly, the extrinsic evidence does not support adopting Cree's proposed construction, and the meaning of the term "density of dislocations" cannot be limited as Cree desires.

The term cannot be limited as Fox desires either, as there is no indication that the patent requires limiting the dislocations counted to those crossing the surface of an axial region.[20] The claims and the specification simply refer to the density of dislocations in the as-grown SiC material. See, e.g., '130 patent col.3 ll.17-19; id. col.8 ll.6-8. As the claims are not limited to any particular measurement technique, and for the above reasons, the court construes "density of dislocations" to mean "concentration of those defects in which lines of atoms in a crystal structure are displaced, including screw, edge, and basal plane dislocations."

3. "density of micropipes"

As noted, the parties' disagreement as to the proper technique for measuring defects in an axial region of the as-grown SiC material informs their respective constructions of the density limitations in the claims, including the term "density of micropipes," which appears in claims 1, 7, 13, and 19.[21] The parties agreed that the term "micropipes" should be construed as "screw dislocations with empty cores, also called microtubes, micropores, or pores." See, e.g., Cree's Reply Claim

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[20] To the extent the proper measurement technique is relevant to the parties' claims, it is a matter to be resolved by the trier of fact.

[21] See supra note 16 and accompanying text.

Construction Br. 7. They disagree as to the proper construction of "density of" as that phrase relates to micropipes, offering the same respective constructions of that phrase as they did with the term "density of dislocations."[22] Indeed, their arguments are identical. Nothing in the record supports a different construction of the phrase "density of" here. Accordingly, the court incorporates its previous construction analysis,[23] and construes the term "density of micropipes" to mean "concentration of micropipes."[24]

4. "density of secondary phase inclusions"

The term "density of secondary phase inclusions" appears in claims 1, 7, 13, and 19. As with the preceding two terms, Fox's proposed construction of the term has "density of" meaning "concentration of." Cree proposes that "density of" and "secondary phase inclusion" be separately construed, and, again, seeks a construction of "density of" that parallels the applicable unit of measurement set forth in the claim language. In the case of secondary phase inclusions, the claims set forth

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[22] Fox proposes "concentration of," whereas Cree proposes, "the total length of dislocation per unit volume."

[23] Supra 26-29.

[24] At this stage of the proceeding, the court does not incorporate the parties' agreed construction of "micropipe" into its construction of the disputed term.

a unit of "cubic centimeter[s]," and so Cree seeks a construction that means "the number of inclusions per unit volume." The parties' arguments in support of their constructions of the phrase "density of" are, again, identical to those offered in regards to the term "density of dislocations," and nothing in the record supports a different construction of that phrase here.[25] Accordingly, the court incorporates its previous construction analysis,[26] and construes the phrase "density of" to mean "concentration of."

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[25] The claims and specification refer to the secondary phase inclusion density in the same manner as they refer to the dislocation and micropipe densities -- by the unit of measurement explicitly set forth therein. See, e.g., '130 patent col.7 ll.49-54 ("The density of dislocations was in the range of 10^2 and 10^4 per square centimeter, . . . [t]he density of micropipes was less than 10 per square centimeter while the density of secondary-phase inclusions . . . was 10 per cubic centimeter."); col.8 ll.6-11. Unlike with those two other defects, though, that reference supports Cree's proposed construction of the phrase "density of" in relation to the term "secondary phase inclusions" because a defect can only be measured per cubic centimeters if it is quantified by the number of occurrences:

(number of occurrences) / volume in centimeters

= per cubic centimeter.

Cf. supra note 17 and accompanying text. This point is self-evident, though, and so Cree's proposed construction is not necessary.

[26] Supra 26-29.

The parties cannot agree on the proper construction of the term "secondary phase inclusions." Fox proposes it means "polytypes different than the polytype of the bulk silicon carbide crystal material and/or precipitates of silicon, carbon, and tantalum or niobium, and their compounds." Cree proposes that the term "inclusion" should be separately defined and mean a "feature in a material not identical to the material matrix." Cree proposes that the term "secondary phase inclusion" means "an inclusion of material other than the primary phase such as other polytypes of silicon carbide, inclusions of carbon, silicon, tantalum or their compounds." Both parties agree that polytypes different than the main polytype of SiC in the SiC crystal constitute a secondary phase inclusion. See '130 patent col.1 ll.49-54. The dispute centers on what else may constitute one. The term's ordinary meaning as understood by a person of skill in the art is not readily apparent, and the claims do not define "secondary phase inclusions." Accordingly, the court must examine the evidence.

The claims do not define the term "secondary phase inclusions," but they provide guidance in formulating its proper construction in two important respects. First, the claims consistently and exclusively refer to "secondary phase inclusions" as a unitary term; there is no separate reference to

"inclusions." Accordingly, by parsing the phrase into two, Cree impermissibly reads the claim term outside the context of the claims in which it appears. See Phillips, 415 F.3d 1313. Moreover, Cree reads it outside the context of the specification, see id., which also refers to "secondary phase inclusions" as a unitary term.[27]

Second, Cree's definition is overbroad because it encompasses explicit limitations set forth in the dependent claims. Dependent claims 2 through 5, 8 through 11, 14 through 17, and 22 through 25 each assert impurity concentrations of either tantalum or niobium "uniformly distributed throughout the re-crystallized single crystal silicon carbide material" for independent claims 1, 7, 13, and 19, respectively. E.g., '130 patent col.8 ll.15-17. Since "the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim," Phillips, 415 F.3d at 1315, the court

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[27] Cree highlights one instance in which the word "inclusion" is independently used: "inclusion of tantalum." '130 patent col.2 l.41. Cree takes this reference out of context. The sentence in question employs the word "inclusion" to mean one affirmatively including tantalum as part of the growth technique; a sense different than that which Cree proposes. Id. ("[I]t was shown that the inclusion of tantalum (Ta) during the sublimation growth of monocrystalline SiC resulted in the vapor medium produced in the growth zone being close to the SiC-Si system.")

presumes that the term "secondary phase inclusions" does not encompass tantalum and niobium impurities that are uniformly distributed throughout the as-grown SiC material. In other words, to the extent tantalum or niobium can be a secondary phase inclusion, they must not be uniformly distributed. See '130 patent col.7 ll.51-57.

The specification provides further guidance. The background of the invention describes a growth technique in which, "during the early stages of growth, secondary-phase inclusions of tantalum or its compounds were formed." Id. col.2 ll.45-47. This reference reveals that tantalum or its compounds can be a secondary phase inclusion. The next sentence provides guidance into the form those materials must exist in to constitute secondary phase inclusions: "An increased concentration of dissolved tantalum in the monocrystalline SiC was also noted." Id. ll.47-49 (emphasis added). As dissolved tantalum in the SiC crystal is references as an additional feature, one can infer that secondary phase inclusion tantalum must be in a solid form that is separate from the crystal. In other words, it must be a "precipitate," as Fox proposes.[28] This

[28] A precipitate is "a substance separated from a solution or suspension by chemical or physical change usually as an insoluble amorphous or crystalline solid." Merriam-Webster's Collegiate Dictionary 977 (11th ed. 2011); see Phillips, 415 F.3d at 1322 ("Dictionaries . . . are often useful to assist in

construction is consistent with the court's finding that tantalum uniformly distributed in the SiC material is not a secondary phase inclusion.[29]

The examples detail an as-grown SiC crystal with a "density of secondary-phase inclusions (i.e., carbon and silicon)." Id. col.7 ll.52-53 (emphasis added). Accordingly, it is clear that carbon and silicon can each be a secondary phase inclusion. The above findings with respect to the form tantalum must take to be a secondary phase inclusion -- a precipitate -- suggest that the same is true with respect to silicon and carbon. Moreover, such a construction is consistent with the rest of the claims and specification, which contemplate silicon and carbon either combining to form the desired low-defect SiC material or existing as a defect within said material. Considering that dislocations and micropipes are defects in which lines of SiC

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understanding the commonly understood meaning of words and have been used both by our court and the Supreme Court in claim interpretation." (citations omitted)). As this definition "does not contradict any definition found in or ascertained by a reading of the patent documents," id. at 1322-23 (citations omitted), use of the word "precipitate" in the court's construction of "secondary phase inclusions" is appropriate. See '130 patent col.1 ll.49-53 ("[E]xcessive silicon in the growth zone may result both in the formation of defects on the growing surface of the SiC crystal, primarily due to the precipitation of excess silicon drops, and in the generation of polytypes differing from the seed polytype." (emphasis added)).

[29] Supra 33-34.

atoms are displaced, silicon and carbon individually can only be defects if they exist outside the crystalline structure of the SiC material; in other words, as a precipitate.

Finally, the specification supports including niobium in the court's construction of secondary phase inclusions. Unlike silicon, carbon, and tantalum, there is no explicit reference to niobium as a secondary phase inclusion. However, niobium is the only other element besides those three described in the patent, and there is no basis to exclude it as a possible secondary phase inclusion. Indeed, it is logical to include niobium because the patent contemplates an embodiment of the invention in which the crucible is comprised of a niobium, silicon, and carbon composition, see id. col.3 ll.38-60 (describing a crucible "fabricated from tantalum or niobium"); id. col.4 ll.59-65; there is potential for niobium to become a precipitate just like tantalum, silicon, and carbon.

Considering the claims, and reading the specification as "provid[ing] an example of how to practice the invention in a particular case," Phillips, 415 F.3d at 1323, it is appropriate to define "secondary phase inclusions" by reference to precipitates of silicon, carbon, tantalum, and niobium. The patent is clear that any SiC that practices the invention of the '130 patent must be grown through a method and apparatus that

employs silicon, carbide, and either tantalum or niobium. See '130 patent col.3 ll.28-40 (summarizing the invention as comprised of "a SiC source and a SiC seed crystal" and a "crucible [that] is comprised of tantalum or niobium"). It is inappropriate, however, to limit the term's construction to only those precipitates, as the patent provides that "the present invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. Accordingly, the disclosures and descriptions herein are intended to be illustrative, but not limiting, of the scope of the invention which is set forth in the following claims." Id. cols.7 l.66 - 8 l.4 (emphasis added). In other words, the patentee did not "intend[] for the claims and the embodiments in the specification to be strictly coextensive," Phillips, 415 F.3d at 1323, and, therefore, other embodiments of the '130 patent's invention may potentially grow SiC material with precipitates of other materials. For all the above reasons, the court construes the term "density of secondary phase inclusions" to mean "concentration of polytypes different than the polytype of the silicon carbide crystal material and/or precipitates of material such as silicon, carbon, and tantalum or niobium, and their compounds."[30]

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[30] The patent does not reveal a method directed toward "bulk"

B. '026 Patent

The court construes the following terms found in claims 1 and 7: (1) "dislocations," (2) "density of defects," (3) "region of re-crystallized silicon carbide,"[31] (4) "axial region of re-crystallized silicon carbide,"[32] (5) "axial growth path,"[33] (6) "lateral region,"[34] (7) "laterally expanding growth path,"[35] and (8) "wherein an outermost edge of said second crystallization growth front is at an angle of greater than 25 degrees as measured from a normal growth axis."[36]

1. "dislocations"

The parties agree that the term "dislocations" should be construed here as it is construed in the '130 patent. Accordingly, "dislocations" means "defects where lines of atoms

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growth. Supra 22-24. Accordingly, Fox's proposed limitation of "bulk silicon carbide crystal material" is inappropriate.

[31] In some of the parties' briefs, they mistakenly refer to the term as "region of re-crystallized single crystal silicon carbide." There is no region term in the '026 patent that employs the phrase "single crystal." The court construes the term as set forth in the claims.

[32] See supra note 31. This term is only found in claim 1.

[33] This term is only found in claim 7.

[34] This term is only found in claim 1.

[35] Supra note 33.

[36] Supra note 33.

in a crystal structure are displaced, including screw, edge, and basal plane dislocations."[37]

2. "density of defects"

Fox proposes that "density of defects," which appears in claims 1 and 7 be construed as one term, and Cree proposes that "density of [defects]"[38] and "defects, said defects comprised of micropipes and dislocations" be separately construed. Fox's proposed construction is "concentration of dislocations and micropipes and other defects that intersect the surface being measured."[39] Cree construes "a density of [defects]" in the same manner it did with the '130 patent.[40] As such, if a defect is a dislocation or micropipe, "a density of" is "the total length of dislocations or micropipes per unit volume." If a defect is a secondary phase inclusion, "a density of" is "the number of inclusions per unit volume." Cree construes the phrase "defects, said defects comprised of micropipes and dislocations" to mean "irregularities in the silicon carbide including

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[37] See supra 25.

[38] See supra note 5.

[39] Fox's proposed construction is a revision from that provided in its claim construction brief. See Fox's Supplemental Claim Construction Mem. 5.

[40] See supra 25-27, 29-31.

micropipes (if any), dislocations and inclusions in the density measurement."[41]

Considering Fox's proposed construction, it is clear that the parties dispute the construction of the term "density of defects, said defects comprised of micropipes and dislocations." Once again, the parties' disagreement as to the proper technique for measuring defects in the region of as-grown SiC in question informs their respective proposed constructions of the term "density of."[42] Likewise, the parties' arguments in support of their proposed constructions are identical to those regarding the term "density of" in the '130 patent. As nothing in the record supports a different construction of that phrase in the '026 patent, the court incorporates its previous construction analysis,[43] and construes "density of" to mean "concentration of."

The parties cannot agree on whether "defects" requires construction. Fox's proposed construction retains the word "defect," but Cree substitutes it with the phrase "irregularities in the silicon carbide." Curiously, though,

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[41] Cree's proposed construction is a revision from that provided in its claim construction brief. See Cree's Supplemental Claim Construction Mem. 9.

[42] See, e.g., supra 26-27.

[43] Supra 26-29.

Cree is satisfied to construe "dislocations" as "defects where lines of atoms in a crystal structure are displaced, including screw, edge, and basal plane dislocations."[44] Cree does not offer any reason to replace "defect" with "irregularities in the silicon carbide," nor does the court find one. The court would risk unneeded confusion by separately construing the word "defect" because it is consistently and repeatedly found throughout the patent. See, e.g., '026 patent col.1 ll.10-12 ("The present invention relates . . . to a method and apparatus for growing low defect density silicon carbide."); id. col.2 ll.19-21 ("[D]efect propagation and generation in the laterally grown material are substantially reduced, if not altogether eliminated."); id. col.4 ll.42-43 ("[D]islocations and other material defects propagate within the core region . . . ."). The word "defect" requires no construction because it expresses the ordinary and customary meaning that a person ordinarily skilled in the art reading the entirety of the patent would ascribe to it. See ICU Med., Inc. v. Alaris Med. Sys., Inc., 558 F.3d 1368, 1374 (Fed. Cir. 2009) ("[T]he person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the

[44] See supra Part IV.B.1.

specification." (emphasis added) (citations and internal quotation marks omitted)).

The parties agree that the claim language "said defects comprised of micropipes and dislocations" conveys that defects are not limited to micropipes and dislocations, see CIAS, 504 F.3d at 1360, but they nonetheless offer different constructions. In order to resolve the controversy, then, the court need only construe the term to express that point. See U.S. Surgical, 103 F.3d at 1568. According to the Federal Circuit, "the term 'comprising' is well understood to mean 'including but not limited to.'" CIAS, 504 F.3d at 1360. Accordingly, the court uses that phrasing to communicate that "the claims do not exclude the presence" in the as-grown SiC material of defects "in addition to those explicitly recited." Id. For all the above reasons, the court construes the term "density of defects, said defects comprised of micropipes and dislocations" to mean "concentration of defects, including but not limited to micropipes and dislocations."

Cree also proposes that the terms "said single crystal silicon carbide seed crystal having a first density of defects," which appears in claims 1 and 7, "said axial region having a second density of defects," which appears in claim 1, and "said lateral region having a third density of defects," which also

appears in claim 1 be construed. Fox does not believe construction of these terms is necessary. Cree proposes that the term "said single crystal silicon carbide seed crystal having a first density of defects" be construed as "measuring the densities of the defects throughout the entirety of the seed crystal." The meaning Cree seeks is readily apparent from the claim language -- the relevant measurement is the density of defects in the single crystal silicon carbide seed, not merely a part of it. See O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co., 521 F.3d 1351, 1361 (Fed. Cir. 2008) (noting that "[a] determination that a claim term 'needs no construction' or has the 'plain and ordinary meaning' may be inadequate . . . when reliance on a term's 'ordinary' meaning does not resolve the parties' dispute" (emphasis added)). The claim language expresses the ordinary and customary meaning that a person ordinarily skilled in the art reading the entirety of the patent would ascribe to it. Accordingly, the term does not require construction.

Similarly, Cree proposes that the other two terms mean "measuring the densities of the defects throughout the entirety of the same [region in question]." Cree's concern is the same one raised with the term "axial region of re-crystallized single crystal silicon carbide" in the '130 patent, as well as that

term and the "lateral region" term in the '026 patent: whether the entirety of the recited region must meet the density limitations or only portions of the regions.[45] See Cree's Opening Br. 20. The terms "said axial region having a second density of defects" and "said lateral region having a third density of defects," do not require construction because the court's construction of those terms' antecedent phrases -- "[comprising an] axial region of re-crystallized silicon carbide" and "[comprising a] lateral region" -- will resolve the parties' dispute.[46] See O2 Micro, 521 F.3d at 1361; see also Baldwin Graphic, 512 F.3d at 1342 ("The subsequent use of definite articles 'the' or 'said' in a claim to refer back to the same claim term does not change the general plural rule [of the word 'an'], but simply reinvokes the non-singular meaning.").

3. "region of re-crystallized silicon carbide"

Fox proposes that the term "region of re-crystallized silicon carbide," which appears in claims 1 and 7 be construed, and Cree proposes that the term "[region of] re-crystallized

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[45] See supra 17-18; infra 49 and 58.

[46] To the extent those terms must be reconciled with the court's construction of their antecedent phrases, the court replaces both "axial region" and "lateral region" with the word "portion." See infra Parts IV.B.3., 4., and 6. (construing the antecedent phrases).

[silicon carbide or single crystal silicon carbide]" be construed.[47] Fox's proposed construction is "portion of a bulk crystal grown by physical vapor transport."[48] Cree's proposed construction is "region of silicon carbide crystal made into a crystal again."

The parties' proposed constructions and arguments are the same as those raised in regard to the term "axial region of re-crystallized single crystal silicon carbide" in the '130 patent. This is sensible because the '026 specification describes the same method of growing SiC as the '130 patent -- source material is heated until it becomes a vapor, which subsequently condenses on the seed to form a SiC crystal. Similar to the '130 patent, the background of the '026 invention describes a method in which "SiC is formed on a bulk single crystal of SiC . . . by chemical vapor deposition." '026 patent col.1 ll.54-59. Also like the '130 patent, the description of the invention establishes that the claimed invention is predicated on a growth method in which source SiC sublimes and then condenses on the seed crystal. See id. col.2 ll.12-13 (describing the invention as "using sublimation techniques"); id. ll.65-67 ("In at least one

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[47] See supra note 5.

[48] Fox's proposed construction is a revision from that provided in its claim construction brief. See Fox's Supplemental Claim Construction Mem. 6.

embodiment, a SiC seed crystal is introduced into a sublimation system . . . ."); id. col.6 ll.49-59 (describing the preferred embodiment of the invention in which "[a] source [] is placed within a growth chamber []," "[s]eed crystal . . . [is] then located within the growth chamber," and "quasi-equilibrium vapor phase conditions [are] maintained"). Indeed, the only difference between the methods in the two patents is that in the '026 patent, "[t]he SiC crystal, grown using sublimation techniques, is divided into two stages of growth" -- growth in the axial and lateral directions, and then primarily in the axial direction.[49] Id. col.2 ll.12-15 and 21-24 (emphasis added).

Unlike the '130 patent, though, the '026 patent is directed toward "bulk" growth. Dependent claim 5 describes a SiC material of claim 1 in which both the axial and lateral regions are at least once millimeter thick. Dependent claim 6 describes a SiC material of claim 1 in which both the axial and lateral regions are at least one centimeter thick. Dependent claims 12 and 13 describe the same in regards to SiC material described in claim 7. Considering that the background of the invention provides that "bulk materials [are] materials at least a

[49] Although not relevant to this term's construction, this distinction is relevant to the remaining disputed terms.

millimeter thick or more preferably, at least a centimeter thick," id. col.1 ll.65-67, dependent claims 5, 6, 12, and 13 serve as "valuable sources of enlightenment" that the patent contemplates bulk growth. Phillips, 415 F.3d at 1314. Moreover, the specification clearly indicates that the '026 patent's invention is a method directed toward growth of high quality, bulk SiC. See '026 patent col.2 ll.2-7 ("[W]hat is needed in the art is a technique of growing bulk SiC material with [low] defect densities . . . . The present invention provides such a technique and the resultant material.").

For the above reasons, and in light of the court's construction of a parallel term in the '130 patent, the court construes "region of re-crystallized silicon carbide" to mean "portion of a bulk silicon carbide crystal that is grown by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal."[50]

4. "axial region of re-crystallized silicon carbide"

Fox proposes that the term "axial region of re-crystallized silicon carbide," which appears in claim 1 be construed, and Cree proposes that the term "axial region [of re-crystallized silicon carbide], said axial region grown off of [said single

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[50] See supra note 12.

crystal silicon carbide seed crystal]" be construed.[51] Fox's proposed construction is "portion of a bulk crystal grown in a direction substantially perpendicular to the seed crystal plane by physical vapor transport and having a higher density of defects than the lateral region."[52] Cree's proposed construction is "the single and entire region extending in a direction perpendicular (i.e., normal) to and from the seed crystal and that excludes the lateral region."[53]

The court has already construed the term "region of re-crystallized silicon carbide," so the issue in dispute is the meaning of that phrase in the context of the word "axial" and the phrase "said axial region grown off of said single crystal silicon carbide seed crystal." There is no substantive dispute as to the meaning of "axial," and so the court again adopts Fox's proposed construction and finds that it means "a direction substantially perpendicular to the seed crystal plane."[54]

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[51] See supra note 5.

[52] Fox's proposed construction is a revision from that provided in its claim construction brief. See Fox's Supplemental Claim Construction Mem. 6.

[53] Cree's proposed construction is a revision from that provided in its claim construction brief. See Cree's Supplemental Claim Construction Mem. 3.

[54] See supra 16.

The parties dispute three aspects of the term. First, Cree argues that there is only one axial region in the SiC crystal grown via the method and apparatus described in the '026 patent, and it must meet the claimed defect densities. The court rejects this construction in construing the parallel term in the '130 patent, and nothing in the '026 patent calls for a different conclusion here. Like the '130 patent, all of the disputed claims in the '026 patent describe "a silicon carbide material comprising an axial region of re-crystallized silicon carbide," which means there are "one or more" axial regions unless the patentee expresses a clear intent to limit it to one.[55] Also like the '130 patent, there is no indication in the patent of such an intent. Cree claims that figures in the patent indicate a single axial region -- for example, **101** in figure 1 below.

[55] Supra 18-19.

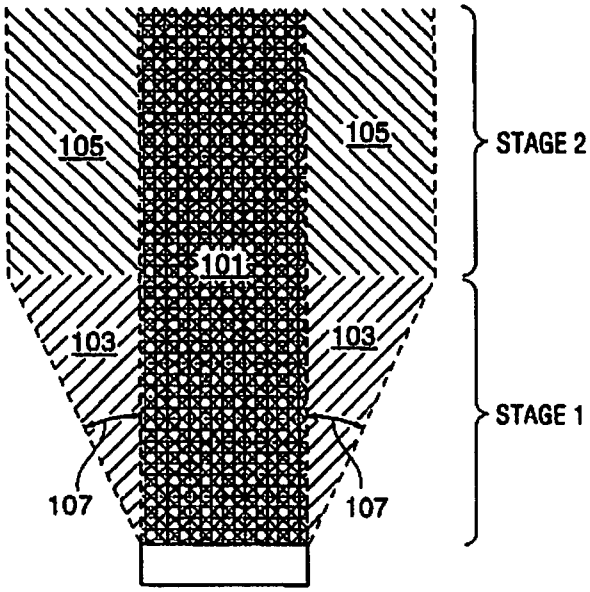

FIG. 1

This is wrong. The specification describes the area Cree references as the "core region," not the "axial region." Discussion of the core region does not clearly establish the patentee's intent to limit "an axial region" to one. Rather, the term "core region" appears to signify the section of as-grown SiC material in which one or more axial regions are found. The court finds that a person of ordinary skill in the art at the time of the invention would have understood that the '026 patent, like the '130 patent, claims one or more axial regions in the SiC material that meet the claimed defect density, while allowing for other axial regions that do not meet it.

The second disputed aspect is the appropriate way to construe the term so as to differentiate an axial region from a

lateral region. Fox proposes the language "and having a higher density of defects than the lateral region." Fox's proposed construction captures the fact that the patent contemplates a SiC material in which the claimed defect density of a lateral region is less than the claimed defect density of an axial region, see '026 patent col.10 ll.32-34, but this limitation is expressed in other claim terms. See id. ll.25-26 (describing "said axial region [as] having a second density of defects"); id. ll.28-34 (describing "said lateral region [as] "having a third density of defects . . . wherein said third defect density is . . . less than said second defect density"). Accordingly, the court cannot construe the instant term to again differentiate the axial region from the lateral region on the basis of defect density. See Haemonetics Corp. v. Baxter Healthcare Corp., 607 F.3d 776, 781 (Fed. Cir. 2010) (recognizing that the "notice function [of patent claims] would be undermined . . . if courts construed claims so as to render physical structures and characteristics specifically described in those claims superfluous").

Cree proposes the language "and that excludes the lateral region." Cree's proposed construction captures the fact that an axial region and a lateral region are mutually exclusive, see, e.g., '026 patent col.2 ll.35-63 (describing three embodiments

and distinguishing between "an axially grown region" and "a laterally grown region," "a central region" and "a perimeter region," and "a first crystalline growth region" and "a second crystalline growth region," respectively), without importing redundant limitations. The court finds that a person of ordinary skill in the art at the time of the invention would have understood that "an axial region" excludes "a lateral region."[56]

The third disputed aspect of the term is whether the phrase "said axial region grown off of said single crystal silicon carbide seed crystal" should be construed as part of the term. Fox does not construe it, and Cree, despite including the phrase in its proposed term, barely accounts for it in its proposed construction -- Cree merely replaces that phrase with the language "and from the seed crystal." The claim language expresses the ordinary and customary meaning that a person ordinarily skilled in the art reading the entirety of the patent would ascribe to it. "Said axial region" merely invokes the antecedent phrase,[57] see Baldwin Graphic, 512 F.3d at 1342, and "grown off of said single crystal silicon carbide seed crystal"

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[56] The disputed "lateral" terms develop the demarcation between axial regions and lateral regions. See infra Parts IV.B.6. and 7.

[57] See supra note 46.

need not be construed, as the meaning Cree seeks is readily apparent from that claim language -- the crystal grows from the seed crystal. See O2 Micro, 521 F.3d at 1361. Accordingly, the phrase is not included in the court's construction of the disputed term.

For the above reasons, the court construes "axial region of re-crystallized silicon carbide" to mean "portion of a silicon carbide crystal that is grown in a direction substantially perpendicular to the seed crystal plane by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal and that excludes the lateral region."[58]

5. "axial growth path"

Fox proposes that the term "axial growth path," which appears in claim 7, be construed, and Cree proposes that the term "first region [of re-crystallized silicon carbide], said first region [of re-crystallized silicon carbide] initiating at said growth surface of [said single crystal silicon carbide seed crystal], wherein a first portion of a crystallization growth front corresponding to said first region [of re-crystallized silicon carbide] follows an axial growth path" be construed.[59] Fox's proposed construction is "path of growth in a direction

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[58] See supra note 12.

[59] See supra note 5.

substantially perpendicular to the seed crystal plane." Cree's proposed construction is "the single and entire region of silicon carbide extending in the axial direction perpendicular (i.e., normal) to and from the seed crystal and that excludes the lateral region."[60]

The parties' dispute corresponds to their dispute over the claim 1 term "axial region of re-crystallized silicon carbide." The court agrees with Cree that "the use of the phrase 'axial growth path' to define the crystallization growth front of the first region requires that this first region be construed similarly to the axial region." Cree's Opening Br. 28.[61] The specification also demonstrates that claim 7 should be construed consistent with claim 1. See, e.g., '026 patent col.2 ll.35-63. Accordingly, the court incorporates its claim construction

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[60] This proposed construction is a revision from that provided in Cree's claim construction brief. Cree did not explicitly revise its proposed construction for this term, but in light of Cree revising its proposed construction of the term "axial region [of re-crystallized silicon carbide], said axial region grown off of [said single crystal silicon carbide seed crystal]," see supra notes 51 and 53 and accompanying text, it clearly intends the same revisions here. See Cree's Opening Br. 28.

[61] Although Fox does not seek construction of the "first region" term, it signals that it too believes claim 7 should be construed consistent with claim 1. See Fox's Reply Claim Construction Br. 17, ECF No. 67 (responding to Cree's proposed construction by incorporating its argument "with respect to Cree's 'axial' construction").

analysis for the term "axial region of re-crystallized silicon carbide,"[62] and construes "first region of re-crystallized silicon carbide, said first region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal, wherein a first portion of a crystallization growth front corresponding to said first region of re-crystallized silicon carbide follows an axial growth path" to mean:

> portion of a silicon carbide crystal that is grown in a direction substantially perpendicular to the seed crystal plane by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal and that excludes the second region,[63] said first region of re-crystallized silicon carbide initiating at said growth surface[64] of said single crystal silicon carbide seed crystal.[65]

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[62] This includes incorporation of the court's analysis regarding the phrase "said axial region grown off of said single crystal silicon carbide seed crystal" in claim 1, which substantively equates to the phrase "said first region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal" in claim 7. Supra 52-53.

[63] The term "second region" in claim 7 equates to the term "lateral region" in claim 1. See infra Parts IV.B.6. and 7.

[64] The parties agreed that the term "growth surface" in claim 7 means "the surface on which another crystal is grown." At this stage of the proceeding, the court does not incorporate this agreed construction into its construction of the disputed term.

[65] To the extent the phrase "said first region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal" must be reconciled with the court's construction of its antecedent

6. "lateral region"

Fox proposes that the term "lateral region," which appears in claim 1, be construed, and Cree proposes that the term "lateral region [of re-crystallized silicon carbide], said lateral region grown off of [said single crystal silicon carbide seed crystal]" be construed.[66] Fox's proposed construction is "a region grown in a direction substantially perpendicular to the axial direction, and located either: outside the narrowest diameter of the crystal in proximity to the seed; or outside the diameter of and having a lower density of defects than the axial region."[67] Cree's proposed construction is "a region of silicon carbide extending outside the diameter of, and laterally from, the seed crystal and that excludes the axial region."[68]

The court has already construed the term "region of re-crystallized silicon carbide,"[69] so the issue is the meaning of

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phrase, the court replaces "first region of re-crystallized silicon carbide" with the word "portion." See supra note 46.

[66] See supra note 5.

[67] Fox's proposed construction is a revision from that provided in its claim construction brief. See Fox's Supplemental Claim Construction Mem. 7.

[68] Cree's proposed construction is a revision from that provided in its claim construction brief. See Cree's Supplemental Claim Construction Mem. 7.

[69] Supra Part IV.B.3.

that phrase in the context of the word "lateral" and the phrase "said lateral region grown off of said single crystal silicon carbide seed crystal." The parties' dispute corresponds to their dispute over the term "axial region of re-crystallized silicon carbide term." Unlike with the axial term, though, the parties dispute the meaning of the term's directional component. Cree proposed construction merely substitutes the word "lateral" with the phrase "laterally from the seed crystal." This does not clarify the term's meaning. Fox construes the term so that "lateral" means "substantially perpendicular to the axial direction." Considering the court's construction of "axial,"[70] Fox's proposed construction would mean that a lateral region is substantially parallel with the seed crystal plane. This does not accord with claims and specification, which establish that a lateral region is grown at an angle "greater than 25 degrees as measured from a normal growth axis," '026 patent col.11 ll.13-14, but "preferably less than 90 degrees." Id. col.9 ll.42; see id. col.4 ll.65-67; id. col.8 ll.7-13. The claims and specification, read as a whole, establish that a person of ordinary skill in the art at the time of the invention would have understood that the '026 patent claims a lateral region

[70] See supra 48 (construing "axial" as "a direction substantially perpendicular to the seed crystal plane").

grown at an angle greater than 25 degrees as measured from the normal growth axis.[71]

In the second aspect of the parties' dispute, Cree argues that there is only one lateral region in the SiC crystal grown via the method and apparatus described in the '026 patent, and it must meet the claimed defect densities. For the same reasons provided in the court's axial term analysis, the court finds that a person of ordinary skill in the art at the time of the invention would have understood that the '026 patent claims one or more lateral regions in the SiC material that meet the claimed defect densities, while allowing for other lateral regions that do not meet it.[72]

The third disputed aspect of the term is the appropriate way to construe it so as to differentiate a lateral region from an axial region. Fox proposes the language "and located either: outside the narrowest diameter of the crystal in proximity to the seed, or outside the diameter of and having a lower density of defects than the axial region." For the same reasons provided in the court's axial term analysis, the court finds

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[71] The parties agree that the term "normal growth axis," which appears in claim 7, means "the growth axis in the axial direction." At this stage of the proceeding, the court does not incorporate this agreed construction into its construction of the disputed term.

[72] See supra 49-50.

that Fox's proposed construction "and having a lower density of defects than the axial region" is already expressed in other claim terms, and, therefore, the court does not construe the instant term to again differentiate the lateral region from the axial region on the basis of defect density.[73]

Part of Fox's proposed construction generally captures the same meaning as Cree's proposed construction -- the lateral region extends outside the diameter of the seed crystal -- and it is supported by the claims and the specification. The claims set forth that a lateral region, like an axial region, is grown off of the seed crystal, see id. col.10 ll.24 and 29, and the defect density in a lateral region is less than the defect density in an axial region. See id. ll.31-34. The specification explains that an axial region has a higher defect density because it grows within the diameter of the seed crystal, a primary source of defects in the as-grown SiC material; in other words, the lower defect density in a lateral region is attributable to growth extending outside the diameter of the seed crystal. See id. col.3 ll.2-4 ("Propagation of dislocation defects, including micropipes, from the seed crystal into the laterally grown crystal is substantially reduced . . . ."); id. col.4 ll.55-58 ("Preferably the growth surface of

[73] See supra 50-51.

the seed crystal is defect free, thereby minimizing the propagation of defects within the core region of the grown crystal."); id. col.6 ll.8-12; id. ll.31-35; id. col.8 ll.9-13 ("If the angle is less than 25 degrees, the defects of [the] seed crystal . . . will continue to propagate throughout the newly grown crystal.") Accordingly, this limitation on the claim term is appropriate. Cree proposes the additional limitation "and that excludes the axial region." As already discussed, such a construction captures the fact that an axial region and a lateral region are mutually exclusive.[74] The court again finds that a person of ordinary skill in the art at the time of the invention would have understood that a lateral region excludes an axial region.

The last disputed aspect of the term is whether the phrase "said lateral region grown off of said single crystal silicon carbide seed crystal" should be construed as part of the disputed term. For the same reasons provided in the court's axial term analysis, the phrase is not included in the court's construction here.[75]

For the above reasons, the court construes "lateral region of re-crystallized single crystal silicon carbide" to mean

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[74] Supra 51-52.

[75] Supra 52-53.

"portion of a silicon carbide crystal that is grown in a direction extending outside the diameter of the seed crystal at an angle of greater than 25 degrees as measured from a normal growth axis by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal and that excludes the axial region."[76]

7. "laterally expanding growth path"

Fox proposes that the term "laterally expanding growth path," which appears in claim 7, be construed, and Cree proposes that the term "second region [of re-crystallized silicon carbide], said second region [of re-crystallized silicon carbide] initiating at said growth surface of [said single crystal silicon carbide seed crystal], wherein a second portion of said crystallization growth front corresponding to said second region [of re-crystallized silicon carbide] follows a laterally expanding growth path" be construed.[77] Fox's proposed construction is "growth in a direction substantially perpendicular to the axial direction." Cree's proposed construction is "the single and entire region of silicon carbide

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[76] See supra note 12.

[77] See supra note 5.

extending outside the diameter of, and laterally from, the seed crystal and that excludes the first region."[78]

Just as the parties' dispute regarding the claim 7 term "axial growth path" corresponds to their dispute over the claim 1 term "axial region of re-crystallized silicon carbide,"[79] the instant dispute corresponds to the parties' dispute over the claim 1 term "lateral region." The court agrees with Cree that "the use of the phrase 'laterally expanding growth path' to define the crystallization growth front of the second region requires that this second region be construed similarly to the lateral regions." Cree's Opening Br. 25.[80] The specification also demonstrates that claim 7 should be construed consistent with claim 1. See, e.g., '026 patent col.2 ll. 35-63. In order to maintain consistency, though, the court must also construe the phrase "wherein an outermost edge of said second portion of said crystallization growth front is at an angle of greater than

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[78] This proposed construction is a revision from that provided in Cree's claim construction brief. Cree did not explicitly revise its proposed construction for this term, but in light of Cree revising its proposed construction of the term "axial region [of re-crystallized silicon carbide], said axial region grown off of [said single crystal silicon carbide seed crystal]," see supra notes 51 and 53 and accompanying text, it clearly intends the same revisions here. See Cree's Opening Br. 28.

[79] See supra 54-55.

[80] See supra note 63.

25 degrees as measured from a normal growth axis," id. col.11 ll.11-14, because that phrase directly informs the court's construction of the lateral region term in claim 1.[81] In other words, if the court does not construe this phrase as part of the disputed term, then the court would import a redundant limitation into claim 7.[82] See Haemonetics, 607 F.3d at 781. The court incorporates its claim construction analysis for the term "lateral region,"[83] and construes "second region of re-crystallized silicon carbide, said second region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal, wherein a second portion of said crystallization growth front corresponding to said second region of re-crystallized silicon carbide follows a laterally expanding growth path, wherein an outermost edge of said second portion of said crystallization

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[81] It is a basis of the limitation "at an angle of greater than 25 degrees as measured from a normal growth axis." See supra 57.

[82] The term's construction would include a growth angle that is explicit in the phrase in question.

[83] This includes incorporation of the court's analysis regarding the phrase "said lateral region grown off of said single crystal silicon carbide seed crystal" in claim 1, which substantively equates to the phrase "said second region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal" in claim 7. Supra 60.

growth front is at an angle of greater than 25 degrees as measured from a normal growth axis" to mean:

> portion of a silicon carbide crystal that is grown in a direction extending outside the diameter of the seed crystal at an angle of greater than 25 degrees as measured from a normal growth axis by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal and that excludes the first region,[84] said second region of re-crystallized silicon carbide initiating at said growth surface[85] of said single crystal silicon carbide seed crystal.[86]

8. "wherein an outermost edge of said second crystallization growth front is at an angle of greater than 25 degrees as measured from a normal growth axis"

Cree proposes that the term "wherein an outermost edge of said second crystallization growth front is at an angle of greater than 25 degrees as measured from a normal growth axis," which appears in claim 7, be construed, whereas Fox argues that the term requires no construction. The court construes this

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[84] The phrase "first region" in claim 7 equates to "axial region" in claim 1. See supra Part IV.B.5.

[85] See supra note 64.

[86] To the extent the phrase "said second region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal" must be reconciled with the court's construction of its antecedent phrase, the court replaces "second region of re-crystallized silicon carbide" with the word "portion." See supra note 46.

term with the preceding term,[87] and no further construction is necessary.

V. Conclusion

For the foregoing reasons, the court construes the parties' disputed terms and phrases as follows:

'130 patent

(1) "Axial region of re-crystallized single crystal silicon carbide" / "region of axially re-crystallized silicon carbide" means "portion of a silicon carbide crystal that is grown in a direction substantially perpendicular to the seed crystal plane by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal."

(2) "Density of dislocations" means "concentration of those defects in which lines of atoms in a crystal structure are displaced, including screw, edge, and basal plane dislocations."

(3) "Density of micropipes" means "concentration of micropipes."

(4) "Density of secondary phase inclusions" means "concentration of polytypes different than the polytype of the silicon carbide crystal material and/or precipitates of material such as silicon, carbon, and tantalum or niobium, and their compounds."

'026 patent

(1) "Dislocations" means "defects where lines of atoms in a crystal structure are displaced, including screw, edge, and basal plane dislocations."

(2) "Density of defects, said defects comprised of micropipes and dislocations" means "concentration of

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[87] Supra Part IV.B.7.

defects, including but not limited to micropipes and dislocations."

(3) "Region of re-crystallized silicon carbide" means "portion of a bulk silicon carbide crystal that is grown by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal."

(4) "Axial region of re-crystallized silicon carbide" means "portion of a silicon carbide crystal that is grown in a direction substantially perpendicular to the seed crystal plane by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal and that excludes the lateral region."

(5) "First region of re-crystallized silicon carbide, said first region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal, wherein a first portion of a crystallization growth front corresponding to said first region of re-crystallized silicon carbide follows an axial growth path" means "portion of a silicon carbide crystal that is grown in a direction substantially perpendicular to the seed crystal plane by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal and that excludes the second region, said first region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal."

(6) "lateral region of re-crystallized single crystal silicon carbide" means "portion of a silicon carbide crystal that is grown in a direction extending outside the diameter of the seed crystal at an angle of greater than 25 degrees as measured from a normal growth axis by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal and that excludes the axial region."

(7) "second region of re-crystallized silicon carbide, said second region of re-crystallized silicon carbide initiating at said growth surface of said single

crystal silicon carbide seed crystal, wherein a second portion of said crystallization growth front corresponding to said second region of re-crystallized silicon carbide follows a laterally expanding growth path, wherein an outermost edge of said second portion of said crystallization growth front is at an angle of greater than 25 degrees as measured from a normal growth axis" means "portion of a silicon carbide crystal that is grown in a direction extending outside the diameter of the seed crystal at an angle of greater than 25 degrees as measured from a normal growth axis by heating solid silicon carbide to form a vapor that then condenses onto the seed crystal and that excludes the first region, said second region of re-crystallized silicon carbide initiating at said growth surface of said single crystal silicon carbide seed crystal.

The court **DIRECTS** the Clerk to send a copy of this Opinion to counsel for the parties.

IT IS SO ORDERED.

/s/
Rebecca Beach Smith
United States District Judge

Rebecca Beach Smith
United States District Judge

Norfolk, Virginia
June 10, 2011